

WHAT IS CLAIMED IS:

1                   1.       An apparatus comprising:  
2                   walls enclosing a process chamber;  
3                   a wafer susceptor positioned within the chamber;  
4                   a first exhaust conduit in fluid communication with the chamber; and  
5                   a processing gas source in fluid communication with the chamber through a  
6 gas distribution showerhead, the gas distribution showerhead comprising;  
7                   a first channel in fluid communication with the processing gas source  
8                   and with apertures distributed over a lower surface of the showerhead; and  
9                   a second channel separate from the first channel and in fluid  
10                  communication with a second exhaust conduit and with exhaust apertures  
11                  distributed over the lower surface of the showerhead.

1                   2.       The apparatus of claim 1 wherein the apertures define a first area and  
2 the exhaust apertures define a second area.

1                   3.       The apparatus of claim 2 wherein a ratio of the first area to the second  
2 area is substantially constant as a function of radial distance from the center of the gas  
3 distribution showerhead.

1                   4.       The apparatus of claim 2 wherein a ratio of the first area to the second  
2 area varies as a function of radial distance from the center of the gas distribution showerhead.

1                   5.       The apparatus of claim 4 wherein the ratio of the first area to the  
2 second area varies linearly as a function of radial distance from the center of the gas  
3 distribution showerhead.

1                   6.       The apparatus of claim 4 wherein the ratio of the first area to the  
2 second area varies nonlinearly as a function of radial distance from the center of the gas  
3 distribution showerhead.

1                   7.       The apparatus of claim 4 wherein the ratio of the first area to the  
2 second area increases as a function of radial distance from the center of the gas distribution  
3 showerhead.

1                   8.       The apparatus of claim 4 wherein the ratio of the first area to the  
2 second area decreases as a function of radial distance from the center of the gas distribution  
3 showerhead.

1                   9.       The apparatus of claim 1 wherein the first exhaust conduit and the  
2 second exhaust conduit are in fluid communication with a common foreline.

1                   10.      The apparatus of claim 9 wherein the plurality of second channels are  
2 in fluid communication with the foreline through a first valve and the second exhaust conduit  
3 is in fluid communication with the foreline through a second valve.

1                   11.      The apparatus of claim 1 wherein the first exhaust conduit and the  
2 second exhaust conduit are in communication with a common vacuum pump.

1                   12.      The apparatus of claim 1 wherein the first exhaust conduit and the  
2 second exhaust conduit are in communication with separate vacuum pumps.

1                   13.      A method of processing a semiconductor workpiece, the method  
2 comprising:  
3                   flowing a process gas to a semiconductor workpiece through a first plurality of  
4 orifices positioned in a gas distribution faceplate; and  
5                   removing gas from over the semiconductor workpiece through a chamber  
6 exhaust port and a second plurality of orifices positioned in the gas distribution faceplate.

1                   14.      The method of claim 13 further comprising removing the gas through  
2 only the chamber exhaust port prior to flowing the process gas.

1                   15.      The method of claim 13 further comprising removing the gas through  
2 the chamber exhaust port and the second plurality of orifices prior to flowing the process gas.

1                   16.      The method of claim 13 further comprising initially removing gas  
2 through only the chamber exhaust port.

1                   17.      The method of claim 13 further comprising initially removing gas  
2 through only the second plurality of orifices.

- 1                    18.     The method of claim 13 wherein the processing chamber is evacuated  
2     to a pressure below 20 Torr.
- 1                    19.     The method of claim 18 further comprising generating a plasma in the  
2     processing chamber prior to flowing the process gas.
- 1                    20.     The method of claim 13 further comprising adjusting a rate of removal  
2     of gas through the chamber exhaust port during processing.
- 1                    21.     The method of claim 13 further comprising adjusting a rate of removal  
2     of gas through the second plurality of orifices is adjusted during processing.
- 1                    22.     A method of processing a semiconductor wafer in a chamber  
2     comprising:  
3                    inserting a semiconductor wafer into the chamber;  
4                    evacuating the chamber through a first exhaust port;  
5                    introducing at least one process gas through a first set of orifices located on a  
6     surface of a showerhead;  
7                    removing gas through the first exhaust port; and  
8                    removing gas through a plurality of orifices positioned on the surface of the  
9     showerhead.
- 1                    23.     The method of claim 22 wherein a larger volume of gas is removed  
2     through the first exhaust port than is removed through the plurality of orifices.
- 1                    24.     The method of claim 22 wherein the chamber is evacuated to a  
2     pressure below 20 Torr.
- 1                    25.     The method of claim 24 wherein a plasma is generated in the chamber  
2     prior to the step of introducing the at least one process gas.
- 1                    26.     The method of claim 22 wherein removal of the gas through the first  
2     exhaust port and through the plurality of orifices occurs substantially simultaneously.
- 1                    27.     A method of controlling uniformity of a property of a film deposited  
2     on a semiconductor wafer, the method comprising:  
3                    positioning a wafer in a processing chamber;

4                   introducing gases to the wafer through a first plurality of orifices positioned on  
5 a faceplate;  
6                   removing the gases through a second plurality of orifices positioned on the  
7 faceplate; and  
8                   simultaneously removing the gases across a radial exhaust path.

1                   28.     The method of claim 27 further comprising evacuating the chamber  
2 across the radial exhaust path only, prior to flowing the gases.

1                   29.     The method of claim 27 further comprising evacuating the chamber  
2 across the radial exhaust path and the second plurality of orifices prior to flowing the gases.

1                   30.     The method of claim 27 further comprising initially removing the  
2 gases through only the radial exhaust path.

1                   31.     The method of claim 27 further comprising initially removing the  
2 gases through only the second plurality of orifices.

1                   32.     The method of claim 27 wherein the chamber is evacuated to a  
2 pressure below about 20 Torr.

1                   33.     The method of claim 32 further comprising generating a plasma in the  
2 chamber.

1                   34.     The method of claim 27 wherein a rate of removing gas across the  
2 radial exhaust path is adjusted during processing.

1                   35.     The method of claim 27 wherein a rate of removing gas through the  
2 second plurality of orifices is adjusted during processing.